Message

From: Caballero, Kathryn [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=E3C28123C2F148419CB920B5A88B01E8-KCABALLE]
Sent: 9/23/2021 9:32:52 PM
To: Russo, Todd [Russo.Todd@epa.gov]; Kler, Denis [Kler.Denis@epa.gov]; Taylor, Kevin [Taylor.Kevin@epa.gov]; Mills, Andrew [mills.andrew@epa.gov]; Dressler, Jason [Dressler.Jason@epa.gov]; Pratt, Marirose [Pratt.Marirose@epa.gov]; Fried, Gregory [Fried.Gregory@epa.gov]; Foley, Patrick [Foley.Patrick@epa.gov]; Secrest, Cary [Secrest.Cary@epa.gov]
Subject: RE: New Indy Site Visit

Appreciate the update and looking forward to hearing from our team about both the ASB operations and New-Indy's measures to address the CAA 303 order.

Best,
Kathryn

Kathryn Pirrotta Caballero
Acting Deputy Director, Air Enforcement Division
Office of Civil Enforcement
U.S. Environmental Protection Agency
Washington, DC 20460
(202) 564 -1849 (w)
(202) 441 -3905 (c)

From: Russo, Todd <Russo.Todd@epa.gov>
Sent: Thursday, September 23, 2021 5:26 PM
To: Kler, Denis <Kler.Denis@epa.gov>; Taylor, Kevin <Taylor.Kevin@epa.gov>; Mills, Andrew <mills.andrew@epa.gov>; Dressler, Jason <Dressler.Jason@epa.gov>; Pratt, Marirose <Pratt.Marirose@epa.gov>; Fried, Gregory <Fried.Gregory@epa.gov>; Caballero, Kathryn <Caballero.Kathryn@epa.gov>; Foley, Patrick <Foley.Patrick@epa.gov>; Secrest, Cary <Secrest.Cary@epa.gov>
Subject: New Indy Site Visit

All,

Denis, Kevin, Andrew, and Marirose will travel to SC this Monday and will go onsite Tuesday to see the current status of the wastewater treatment system. New Indy took the stripper offline today for maintenance which will last about eight days. While the stripper is offline, all foul condensate will be routed to the ASB. New Indy has installed two probes in the foul condensate hard pipe to monitor the Oxidation Reduction Potential (ORP). New Indy is using ORP to measure the biological oxygen demand which they say is supposed to provide them with an early warning system if levels get out of balance and have potential to create undesirable levels of H2S. If the ORP indicates levels are getting out of balance, they say they can take steps to bring levels back into balance like injecting more peroxide and curtailing production. They've already committed to SC that they will initially curtail production. The team will also look at all of the measures New Indy has been implementing since the 303 Order was issued.

Regards,

Todd Russo
Chief, Air Enforcement Branch
Enforcement and Compliance Assurance Division

U.S. EPA Region 4
Tel: (404) 562-9194

Message

From: Kler, Denis [Kler.Denis@epa.gov]
Sent: 9/8/2021 12:22:24 PM
To: Pratt, Marirose [Pratt.Marirose@epa.gov]; Foley, Patrick [Foley.Patrick@epa.gov]; Taylor, Kevin [Taylor.Kevin@epa.gov]; Mills, Andrew [mills.andrew@epa.gov]; Russo, Todd [Russo.Todd@epa.gov]; Caballero, Kathryn [Caballero.Kathryn@epa.gov]; Fried, Gregory [Fried.Gregory@epa.gov]; Secrest, Cary [Secrest.Cary@epa.gov]; Nowell, Valerie [Nowell.Valerie@epa.gov]; Dressler, Jason [Dressler.Jason@epa.gov]
Subject: RE: New Indy Term Sheet

I made a few comments in the document. I did not participate in the call with Carol yesterday, so I am not sure what was discussed. I did not see a meeting scheduler for the call, but I am sorry if I was supposed to be on the call.
Denis

Denis B. Kler
U.S. EPA Region 4
Enforcement and Compliance Assurance Division
Policy, Oversight and Liaison Office
Phone: 404-562-9199

From: Pratt, Marirose <Pratt.Marirose@epa.gov>
Sent: Wednesday, September 8, 2021 5:54 AM
To: Kler, Denis <Kler.Denis@epa.gov>; Foley, Patrick <Foley.Patrick@epa.gov>; Taylor, Kevin <Taylor.Kevin@epa.gov>; Mills, Andrew <mills.andrew@epa.gov>; Russo, Todd <Russo.Todd@epa.gov>; Caballero, Kathryn <Caballero.Kathryn@epa.gov>; Fried, Gregory <Fried.Gregory@epa.gov>; Secrest, Cary <Secrest.Cary@epa.gov>; Nowell, Valerie <Nowell.Valerie@epa.gov>; Dressler, Jason <Dressler.Jason@epa.gov>
Subject: New Indy Term Sheet
Importance: High

Hi All,

Please find attached an updated term sheet incorporating the items that Carol mentioned yesterday as well as a few minor edits. I marked the substantive additions with blue text. Please review and let me know if you have any suggested edits, revisions, or concerns before noon today.

If you have any trouble accessing the document, please let me know.

Thanks!
Marirose

Marirose J. Pratt
Senior Air Enforcement Attorney
Air & EPCRA Law Office
Office of Regional Counsel
U.S. Environmental Protection Agency, Region 4

Sam Nunn Atlanta Federal Center
61 Forsyth Street, S.W.
Atlanta, Georgia 30303-8960
Phone: 404-562-9023
Fax: 404-562- 9486
pratt.marirose@epa.gov

Stripper Maintenance & Cleaning Outage: September 2021
ORP Control Strategy & Effectiveness for Foul Condensate to ASB

This document assesses the use and effectiveness of Oxidation Reduction Potential (ORP) as a means of proactively treating the unstripped foul condensate during a recent Stripper outage event.
(October 15, 2021)

Objective:
A maintenance and cleaning outage was scheduled in September to address declining performance in the Foul Condensate Stripper operation. During this outage, the foul condensate typically processed through the Foul Condensate Stripper operation would have to bypass the Stripper and go straight (untreated) to the ASB. Historically, this has never been problematic for the mill. However, given the recent issues and concerns with odor and hydrogen sulfide emissions from the mill, New-Indy Catawba developed an alternative means of treating the unstripped foul condensate prior to discharge into the ASB. Accordingly, New-Indy Catawba devised a plan to inject hydrogen peroxide into the hard pipe between the Stripper Feed Tank and the ASB. To control the peroxide dosage, ORP instrumentation was installed with both feedback and feed-forward control logic to maintain peroxide dosage into the foul condensate for the entire outage period.

Control Strategy:
Both industry literature and input from outside environmental consultants were referenced to establish ORP to pre-treat the foul condensate with peroxide to minimize potential hydrogen sulfide generation in the ASB. The control concept uses ORP as an indication of how well sulfur constituents are oxidized by a controlled upstream dosage of hydrogen peroxide. The peroxide injection and ORP measurement are both performed within the hard pipe, between the Stripper Feed Tank and the condensate discharge into the ASB treatment lagoon. The final control strategy included the following characteristics and features:

a) Variable speed, positive displacement chemical dosing pumps (speed directly proportional to flow),
b) ORP probes to monitor effective oxidation of sulfur species,
c) ORP sensor installed far enough downstream of peroxide injection point to accomplish thorough mixing and reaction time,
d) Automatic feedback loop using the ORP to control peroxide pump speed (flow), and
e) Feed forward input from upstream foul condensate conductivity sensor to provide "early warning" of any potential increase in contamination from the condensate sources and initiate a corresponding "bump" to the peroxide pump speed.

With additional input from consultants, New-Indy Catawba decided to implement a conservative control strategy by planning to maintain a positive ORP value (biasing the control scheme towards treatment rather than operating cost). To compensate for process variabilities and control lag times which characterize feedback control loops (time delays between injection and downstream measurement and corrected/adjusted injection flow rates), New-Indy Catawba ultimately chose to go one step further and establish the ORP setpoint at +50mV. The following three additional safety measures were then included in the control scheme, again, to ensure thorough and effective oxidation of sulfur compounds:

1) Always maintain at least a minimum pump speed for the peroxide injection, even if ORP was above the setpoint target,

2) Manual override capability was included to maintain peroxide flow if the ORP sensor failed, and
3) Redundancy: A second peroxide pump and second ORP sensor were installed as emergency spares in the event of primary unit failure.

Implementation:
Prior to committing to the equipment dismantling activities necessary for cleaning and maintenance, the Stripper column had to be boiled out, flushed, and cooled down. During this process of boiling/flushing/cooling, the ORP controls were tested and tuned over a complete range of condensate flow conditions, and then left to run for an extended period to prove the concept and system reliability. The first attempt revealed that additional work was necessary to ensure the system would be robust and sustainable throughout the extended outage duration. The outage was postponed, and the Stripper was put back into full service until the ORP system could be made more reliable. Several days later, following implementation of system improvements, the boil out, flush, and cool down process was once repeated. The ORP controls were again tuned, adjusted, and allowed to run for a long enough period to be proven effective, and the outage commenced.

Monitoring & Reporting:
To ensure that the ORP system was not overlooked while operators performed their normal daily functions, the controls and control performance tracking information was built into the mill's computerized process control system (DCS) used by its operators throughout the plant. The ORP controls information was also imported into the mill's process data historian and published on multiple display pages which could be watched by New-Indy Catawba personnel throughout the plant. Furthermore, at SCDHEC's request, for the duration of the maintenance and cleaning outage event, an email was automatically generated and sent which included both a trend display and tabular data table of rolling 10-minute average ORP values.

Performance & Effectiveness:
The ORP control strategy and implementation was proven successful. Hourly average data through the outage shows that 100% of the processed condensate was kept above 0mV for a 100% positive ORP value. The sustained minimum pump speed resulted in 74% of the condensate being kept at readings between 150-200mV. Figure 1 (end of report) plots the distribution of ORP values in comparison to the percentage of treated condensate at those readings.

Post outage, the ORP system has maintained a success rate very similar to that during the outage. One short duration event has kept the ORP system from maintaining 100% of the data above 0mV, and this was due to an upset in steam pressure to the Stripper operation. That said, 98% of the condensate processed since the outage has been maintained with a positive ORP reading. Figure 2 demonstrates the post-outage system performance.

System Limitations:
A) The current system uses ORP as a surrogate to control "potential to emit." Other sensors may prove to be more effective, but better options have not yet been identified.

B) Concentration of individual components is not a known or measurable characteristic. Consequently, the condensate's conductivity in the Stripper Feed Tank has always been used as a surrogate to indicate the presence of black liquor contamination. Given that black liquor contains sulfurous components, the conductivity reading is now used to "bump" the pump speed if a sudden increase occurs upstream of the peroxide injection point.

Key Opportunities for Improvement:

Several opportunities exist for potential improvement to the existing ORP control system, each of which will receive further investigation to determine its true merit.

1) Upgrade the second peroxide pump connectivity so it can be used automatically if the primary pump fails.
2) Upgrade the second ORP sensor connectivity so it can be automatically switched into "control" if the primary sensor fails.
3) Monitor ORP, DO, something else: Some literature suggests that DO could also be utilized. Additional investigation is required to determine which sensor provides the best responsiveness and durability for control.
4) Peroxide: Evaluate if there is another chemical or oxidation approach to accomplish the intended treatment of the foul condensate.
5) Controls tuning: The system has performed well throughout both the outage and post-outage periods. However, the ORP values continued to run well above the "necessary" point of -50mV, and even well above a positive value on a conservative basis. Also, the spread of ORP data is much less tightly controlled with the reduced flow rates in the post-outage period. That said, the base pump speed can probably be adjusted, and additional control features may be capable of better managing the cost of peroxide treatment without compromising treatment efficacy.

Conclusions:

1) The intended goal of effectively maintaining a positive ORP with peroxide has been successfully accomplished.
2) The system can certainly be improved from an operating cost standpoint.
3) Treatment efficacy can be improved with some upgrades to the hardware and instrumentation connectivity, and potential alternative instrumentation devices.

Pete Cleveland
Technical Manager

ATTACHMENTS:
Figure 1 – ORP Frequency Trend – Outage Period
Figure 2 – ORP Frequency Trend – Post Outage

FIGURE 1 *(107 data points)*

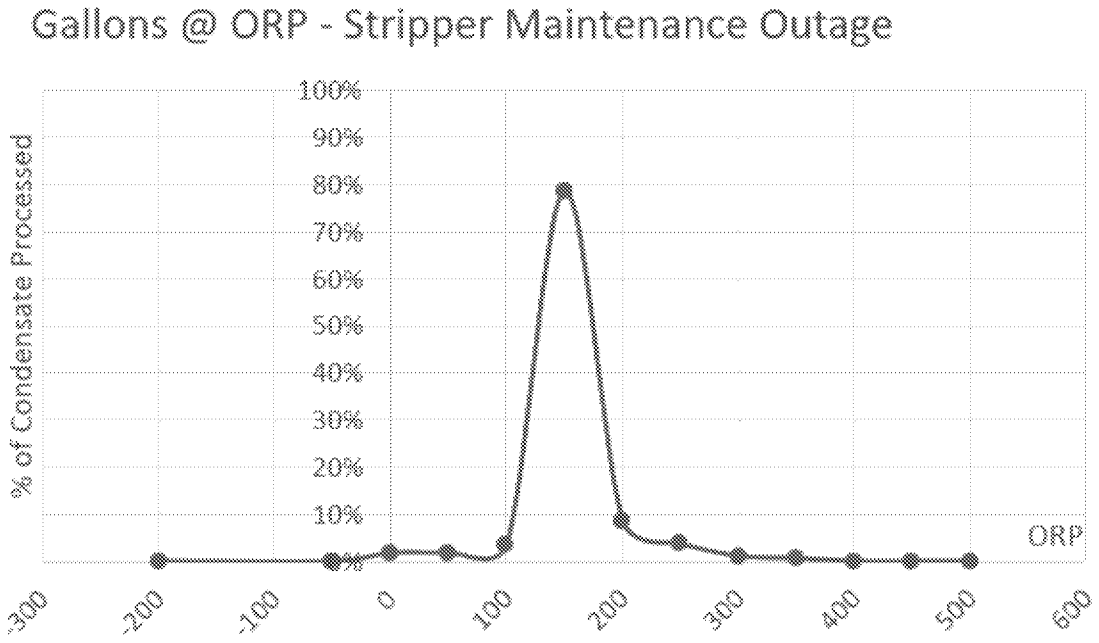
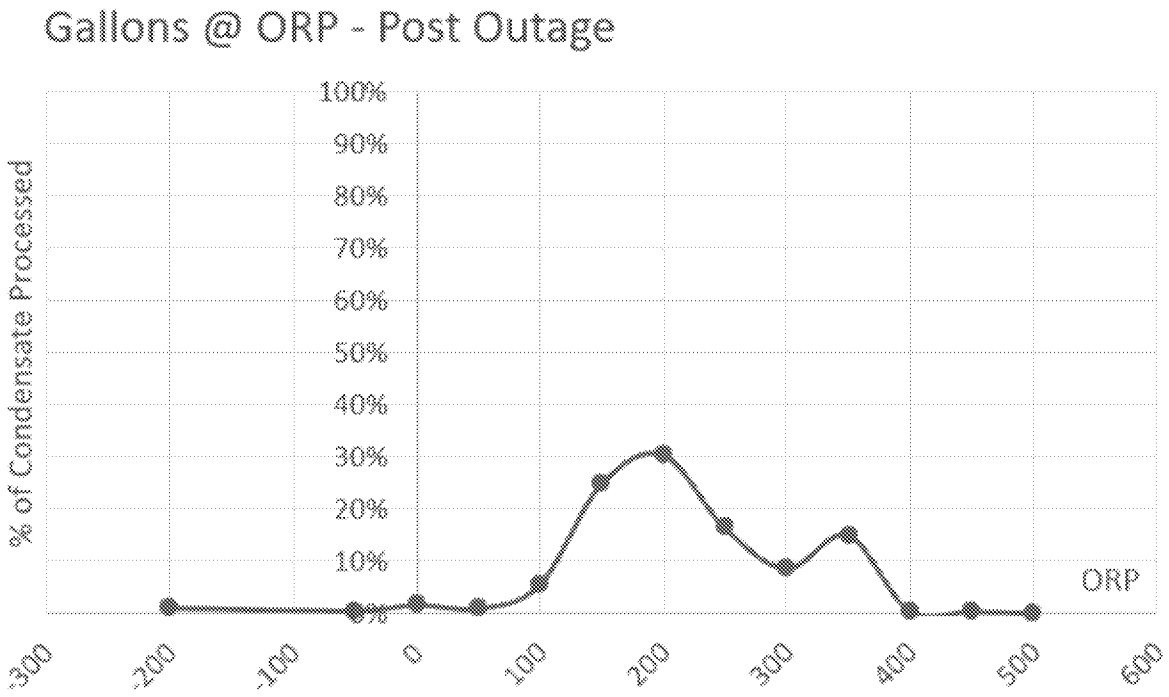


FIGURE 2 *(356 data points)*



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Pete Cleveland
Technical Manager

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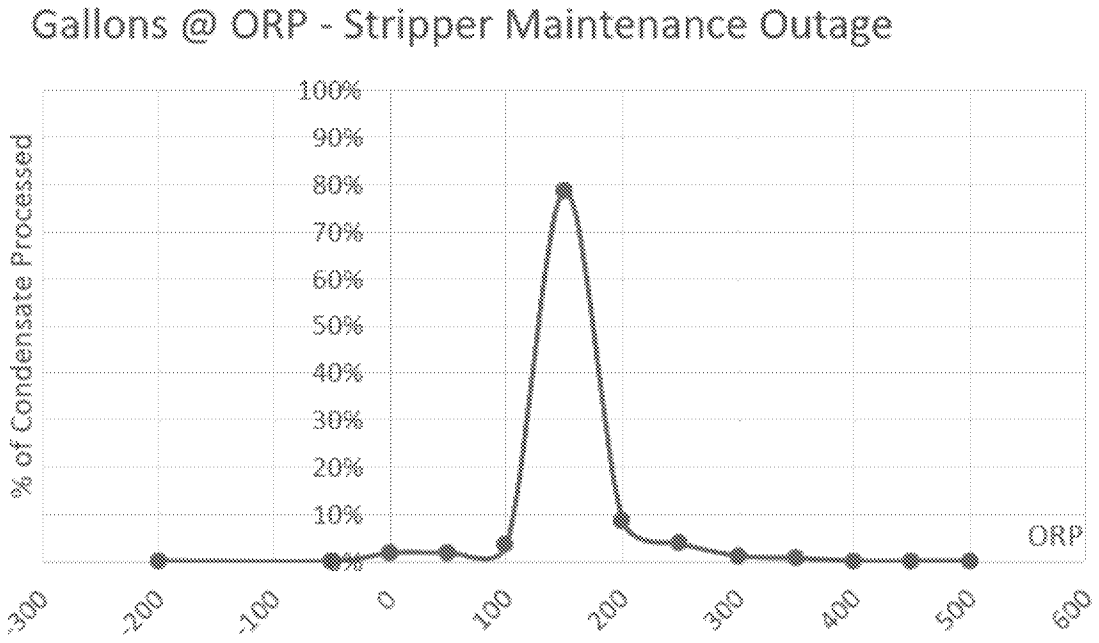
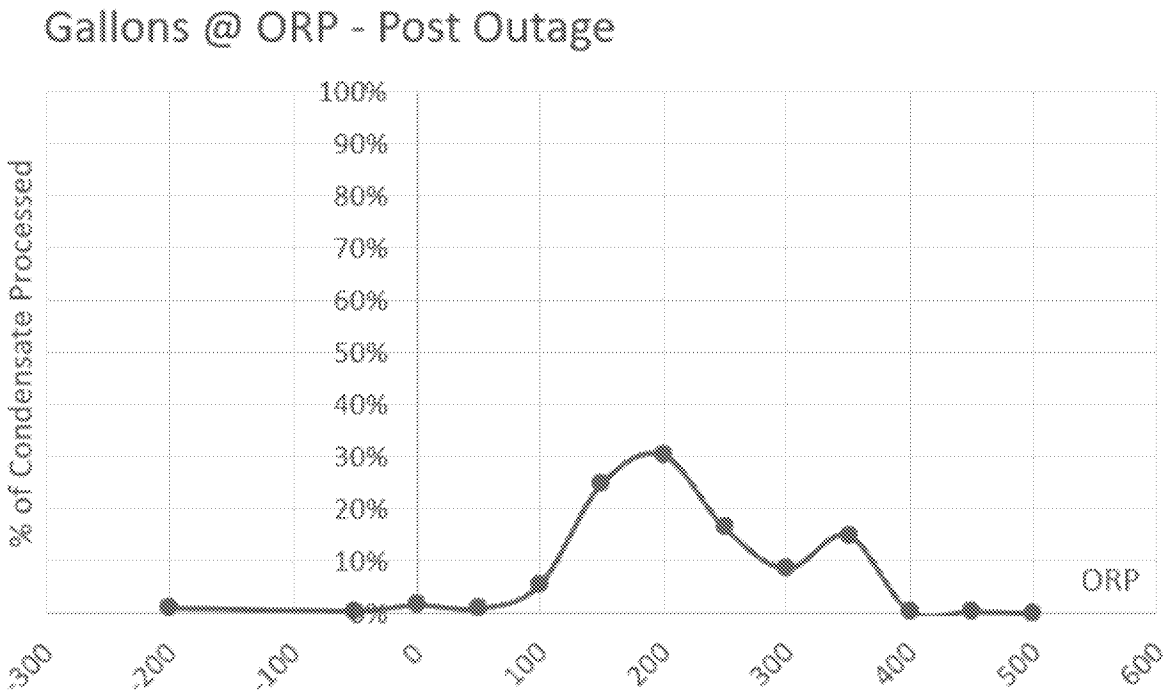


FIGURE 2 *(356 data points)*



Message

From: Stephanie Blackman [sblackman@SchwarzPartners.com]
Sent: 10/27/2021 6:19:04 PM
To: Pratt, Marirose [Pratt.Marirose@epa.gov]; O'Rourke, Steve (ENRD) [Steve.O'Rourke@usdoj.gov]; Valenzuela, Johanna (USASC) [Johanna.Valenzuela@usdoj.gov]; England, JJ [England.Jj@epa.gov]; Caballero, Kathryn [Caballero.Kathryn@epa.gov]; Nowell, Valerie [Nowell.Valerie@epa.gov]
CC: Cobery, Jim [JimC@TheKraftGroup.com]; Weber, Steven D. [steveweber@parkerpoe.com]; Golden, Rebecca (RebeccaG@thekraftgroup.com) [RebeccaG@thekraftgroup.com]; Sparks, Mallory S. [mallorysparks@parkerpoe.com]; Stephanie Blackman [sblackman@schwarzpartners.com]
Subject: RE: [External] New Indy - Draft Consent Decree
Attachments: ENV_ENFORCEMENT-#3011985-v1-nic_settle_CD-New-Indy_10.27.2021_clean.docx; ENV_ENFORCEMENT-#3011985-v1-nic_settle_CD-New-Indy_10.27.2021_marked.docx

Hi Everyone,

Attached please find New-Indy's comments to EPA's proposed draft Consent Decree. Jim and I are happy to discuss at your convenience.

Regards,
Stephanie

Stephanie A.H. Blackman
VICE PRESIDENT & GENERAL COUNSEL

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CARMEL, INDIANA 46032

317.290.1140 (office) | 317.292.0520 (cell)
sblackman@schwarzpartners.com
www.schwarzpartners.com

From: Pratt, Marirose <Pratt.Marirose@epa.gov>
Sent: Thursday, October 7, 2021 3:26 PM
To: Weber, Steven D. <steveweber@parkerpoe.com>; Cobery, Jim <JimC@TheKraftGroup.com>; Stephanie Blackman <sblackman@SchwarzPartners.com>; Golden, Rebecca (RebeccaG@thekraftgroup.com) <RebeccaG@thekraftgroup.com>; Sparks, Mallory S. <mallorysparks@parkerpoe.com>
Cc: O'Rourke, Steve (ENRD) <Steve.O'Rourke@usdoj.gov>; Valenzuela, Johanna (USASC) <Johanna.Valenzuela@usdoj.gov>; England, JJ <England.Jj@epa.gov>; Caballero, Kathryn <Caballero.Kathryn@epa.gov>; Nowell, Valerie <Nowell.Valerie@epa.gov>
Subject: [External] New Indy - Draft Consent Decree

Good Afternoon,

Please find attached a proposed draft of the Consent Decree for the New Indy CAA 303 matter. As we've mentioned before, this document contains the standard terms, conditions, stipulated penalties, etc. to go along with the more case-specific terms we are concurrently negotiating in the term sheet (which will be fleshed out and attached as an appendix to the Consent Decree).

We realize you will not have enough time to review this before our meeting tomorrow but we still wanted to get it in your hands as soon as possible.

On the topic of tomorrow's meeting, please let me know if you have any specific agenda topics you'd like to discuss. If not, we would be happy to just explain the reasons behind the revisions in the most recent draft of the term sheet.

Thanks,
Marirose

Marirose J. Pratt
Senior Air Enforcement Attorney
Air & EPCRA Law Office
Office of Regional Counsel
U.S. Environmental Protection Agency, Region 4
Sam Nunn Atlanta Federal Center
61 Forsyth Street, S.W.
Atlanta, Georgia 30303-8960
Phone: 404-562-9023
Fax: 404-562- 9486
pratt.marirose@epa.gov

From: Warren, Beth C. (USASC)
To: Valenzuela, Johanna (USASC)
Subject: RE: SC - Support Operations Services (SOS) Affirmative Civil Enforcement (ACE)
Date: Wednesday, October 27, 2021 3:57:26 PM
Attachments: image001.png
image002.png

I would make it less specific and just include FLU (see below). In the [redacted] case, the SA said instructions would come from the USAO, and I asked the contracting group if we could keep that (was it accurate). They said they just stand in the shoes of USAO as a contractor. But, I think using the FLU unit is too specific.

Beth C. Warren
803-929-3037

From: Valenzuela, Johanna (USASC) <JValenzuela@usa.doj.gov>
Sent: Wednesday, October 27, 2021 3:53 PM
To: Warren, Beth C. (USASC) <bwarren@usa.doj.gov>
Subject: RE: SC - Support Operations Services (SOS) Affirmative Civil Enforcement (ACE)

Hi, Beth,

We're in the process of negotiating a consent decree (fingers crossed) in our New-Indy case that we're doing with ENRD (DOJ) & EPA.

Currently, we have a paragraph reads as follows:

Defendant shall pay the civil penalty due by FedWire Electronic Funds Transfer ("EFT") to the DOJ account, in accordance with instructions provided to Defendant by ~~the Financial Litigation Unit ("FLU") of~~ the United States Attorney's Office for the District of South Carolina (USAO-SC) within five business days of the Effective Date. The payment instructions provided by the ~~FLU~~ (USAO-SC) will include a Consolidated Debt Collection System ("CDCS") number, which Defendant shall use to identify all payments required to be made in accordance with this Consent Decree. The ~~FLU~~ USAO-SC will provide the payment instructions to:

I think this is still correct, based on the attached, because the steps say that ENRD will email USAO/FL staff, but should I check with Gayle or Anne or the new SOS staff about this language?

Johanna C. Valenzuela
Assistant U.S. Attorney
District of South Carolina
Office: (803) 929-3122
Cell: (803) 445-7295

From: Warren, Beth C. (USASC) <bwarren@usa.doj.gov>
Sent: Friday, October 15, 2021 12:13 PM
To: USASC-ACE (USA) <USASC-ACE@usa.doj.gov>
Subject: SC - Support Operations Services (SOS) Affirmative Civil Enforcement (ACE)

Ace team,

For those who may have missed the call we had with the new group who will be doing our ACE collections, this email includes contact names and a link to the Sharepoint site where the most updated Ace forms will be kept. Note – you must access the Sharepoint link using Internet Explorer. Using Chrome, the Adobe form will not load.

I realize that some don't yet have the years on them to have gotten to the settlement stage. As a 101—when we settle a case, or

get a judgment, the government has to know where to disburse the money that comes in. The tracking forms direct where the money goes.

Time will tell, but I think this group will be a good resource for the office. It avoids us having to rely on one person to respond to our ACE collections needs. Gayle George has always done an amazing job, but if she's out or busy, we are up the creek. This group does ACE collections for districts across the country and is developing expertise in the area.

They can also help create amortization schedules for payments over time.

I'm going to save this email and the attachment in the Ace Admin drive under Ace Collections:

W:\ACE Admin\Ace Collections

If you have questions about how to handle this part of a settlement—which, surprisingly, can be time consuming—don't hesitate to reach out.

Beth C. Warren
803-929-3037

From: Claure, Stephanie (USAEO) [Contractor] <SClaure@usa.doj.gov>
Sent: Friday, October 15, 2021 11:36 AM
To: Warren, Beth C. (USASC) <bwarren@usa.doj.gov>; Frate, Anne (USASC) <afrate1@usa.doj.gov>
Cc: Curtis, Darrell (USAUT) <DCurtis@usa.doj.gov>; Young, Derrell (USAEO) [Contractor] <DYoung1@usa.doj.gov>
Subject: SC - Support Operations Services (SOS) Affirmative Civil Enforcement (ACE)

Good morning,

Thank you for meeting with us today. We look forward to be able to provide this service for your district. Attached is the FLU SOS REA Advance Services document from your district. You can begin right away in sending new ACE cases to the SOS at USAEO-FL-SOS usaeo.fiscs@usa.doj.gov

If you have any further questions or need any other assistance, please feel free to contact any of the SOS ACE leadership:

Darrell Curtis
FL SOS Program Manager
EOUSA, Legal Programs Representative
Curtis, Darrell (USAUT) DCurtis@usa.doj.gov
801-325-3215 / 202-870-9303

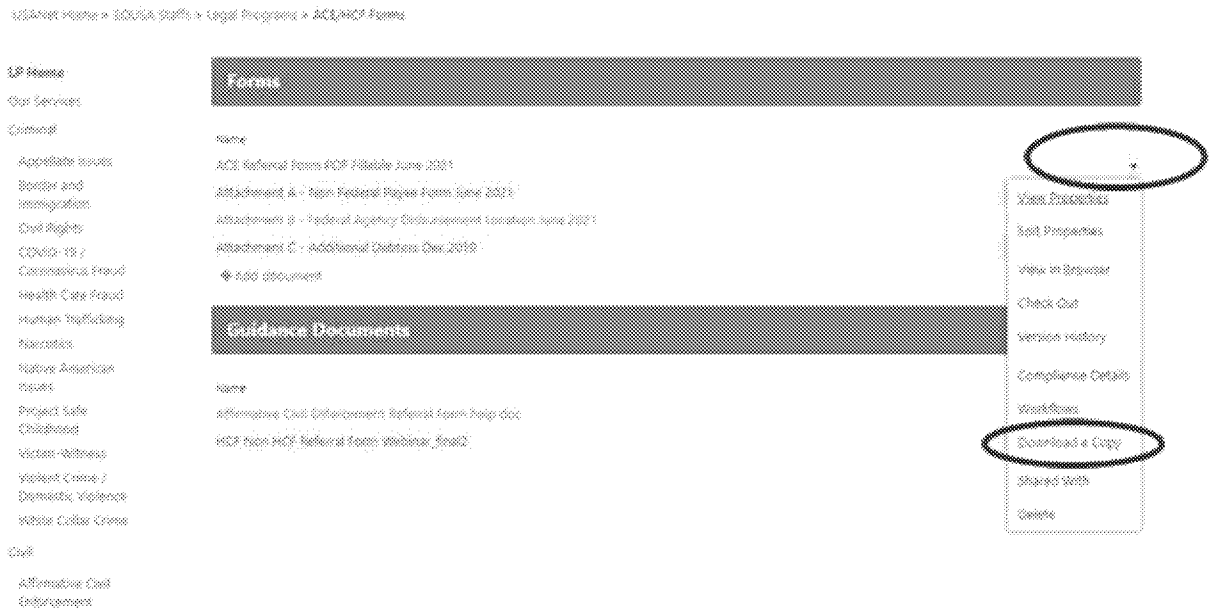
Kyra Gessner
FL SOS Supervisor
Gessner, Kyra (USAEO) [Contractor] KGessner@usa.doj.gov
202-252-5523

Stephanie Claure
FL SOS Supervisor
Claure, Stephanie (USAEO) [Contractor] SClaure@usa.doj.gov
202-252-5522

As we mentioned, please do not save the ACE Referral form to your desktop. Instead go to the following link on the ACE SharePoint site and download the forms.
https://usanet.usa.doj.gov/staffs/oivp/Pages/HCForms.aspx

If you have issues downloading the form, please hover over the "ACE Referral Form PDF Fillable June 2021", click on the down arrow to the right of this field and then click on "Download a Copy" (see below).

ACE/HCF Forms



Please let us know if you have any questions or need any other information.

Thank you,

Stephanie Claure, Contractor
KACE
Senior Records Analyst/Supervisor

FLP Support Operations Services (SOS)
Executive Office for United States Attorneys
Asset Recovery Staff
175 N Street NE, Suite 4.414
Washington, DC 20002
Phone: (202) 252.5522
Stephanie.Claure@usdoj.gov

Message

From: O'Rourke, Steve (ENRD) [Steve.O'Rourke@usdoj.gov]
Sent: 9/8/2021 4:23:44 PM
To: Pratt, Marirose [Pratt.Marirose@epa.gov]; Valenzuela, Johanna (USASC) [Johanna.Valenzuela@usdoj.gov]; Caballero, Kathryn [Caballero.Kathryn@epa.gov]; Nowell, Valerie [Nowell.Valerie@epa.gov]
Subject: RE: New Indy Term Sheet

You need to add a disclaimer: subject to final approval from authorized government officials, a public comment period, and court approval.

Do we need to /should we run this by DHEC to see if they are asking for wildly different things?

From: Pratt, Marirose <Pratt.Marirose@epa.gov>
Sent: Wednesday, September 8, 2021 12:18 PM
To: O'Rourke, Steve (ENRD) <Steve.O'Rourke@usdoj.gov>; Valenzuela, Johanna (USASC) <JValenzuela@usa.doj.gov>; Caballero, Kathryn <Caballero.Kathryn@epa.gov>; Nowell, Valerie <Nowell.Valerie@epa.gov>
Subject: New Indy Term Sheet

Hi Steve and Johanna,

Please find attached EPA's proposed term sheet to settle the CAA 303 judicial action with New Indy. Please let us know if you have any questions or concerns.

Is everyone comfortable with transmitting this to New Indy today?

Thanks!
Marirose

Marirose J. Pratt
Senior Air Enforcement Attorney
Air & EPCRA Law Office
Office of Regional Counsel
U.S. Environmental Protection Agency, Region 4
Sam Nunn Atlanta Federal Center
61 Forsyth Street, S.W.
Atlanta, Georgia 30303-8960
Phone: 404-562-9023
Fax: 404-562- 9486
pratt.marirose@epa.gov

Appointment

From: Pratt, Marirose [Pratt.Marirose@epa.gov]
Sent: 11/3/2021 1:23:57 PM
To: Russo, Todd [Russo.Todd@epa.gov]; Dressler, Jason [Dressler.Jason@epa.gov]; Kler, Denis [Kler.Denis@epa.gov]; Taylor, Kevin [Taylor.Kevin@epa.gov]; Mills, Andrew [mills.andrew@epa.gov]
CC: Foley, Patrick [Foley.Patrick@epa.gov]; Secrest, Cary [Secrest.Cary@epa.gov]; Fried, Gregory [Fried.Gregory@epa.gov]; Nowell, Valerie [Nowell.Valerie@epa.gov]; Caballero, Kathryn [Caballero.Kathryn@epa.gov]

Subject: New Indy - term sheet/Appendix A further discussion if needed
Location: Microsoft Teams Meeting

Start: 11/3/2021 5:00:00 PM
End: 11/3/2021 5:30:00 PM
Show Time As: Tentative

Required Attendees: Russo, Todd; Dressler, Jason; Kler, Denis; Taylor, Kevin; Mills, Andrew
Optional Attendees: Foley, Patrick; Secrest, Cary; Fried, Gregory; Nowell, Valerie; Caballero, Kathryn

<!--[if lte mso 15 || CheckWebRef]-->

Pratt, Marirose has shared a OneDrive for Business file with you. To view it, click the link below.

11-3-21 Draft Appendix A - Work to be Performed.docx

<!--[endif]-->

Hi All,

I am scheduling this time to go over the term sheet/Appendix A that we discussed yesterday afternoon and the revised draft that I shared this morning (attached as a SharePoint doc again for convenience). I want to make sure I capture all of your comments/concerns.

Thanks!
Marirose

Microsoft Teams meeting

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Message

From: Pratt, Marirose [Pratt.Marirose@epa.gov]
Sent: 11/3/2021 5:55:24 PM
To: Russo, Todd [Russo.Todd@epa.gov]; Dressler, Jason [Dressler.Jason@epa.gov]; Kler, Denis [Kler.Denis@epa.gov]; Taylor, Kevin [Taylor.Kevin@epa.gov]; Mills, Andrew [mills.andrew@epa.gov]
CC: Foley, Patrick [Foley.Patrick@epa.gov]; Secrest, Cary [Secrest.Cary@epa.gov]; Fried, Gregory [Fried.Gregory@epa.gov]; Nowell, Valerie [Nowell.Valerie@epa.gov]; Caballero, Kathryn [Caballero.Kathryn@epa.gov]
Subject: RE: New Indy - term sheet/Appendix A
Attachments: Comparison of EPA's 10-7-21 1st CD draft to 11-3-21 2nd CD draft.docx

<!--[if lte mso 15 || CheckWebRef]-->

Pratt, Marirose has shared a OneDrive for Business file with you. To view it, click the link below.

11-3-21 Draft Appendix A - Work to be Performed.docx

<!--[endif]-->

Hi All,

Please find attached a revised term sheet/Appendix A for your review. I am also attaching the current draft of the CD with includes redline changes we have made or accepted since our first draft.

Please let me know if you have any questions.

Thanks!

Marirose J. Pratt
Senior Air Enforcement Attorney
Air & EPCRA Law Office
Office of Regional Counsel
U.S. Environmental Protection Agency, Region 4
Sam Nunn Atlanta Federal Center
61 Forsyth Street, S.W.
Atlanta, Georgia 30303-8960
Phone: 404-562-9023
Fax: 404-562- 9486
pratt.marirose@epa.gov

-----Original Appointment-----
From: Pratt, Marirose
Sent: Wednesday, November 3, 2021 9:24 AM
To: Pratt, Marirose; Russo, Todd; Dressler, Jason; Kler, Denis; Taylor, Kevin; Mills, Andrew
Cc: Foley, Patrick; Secrest, Cary; Fried, Gregory; Nowell, Valerie; Caballero, Kathryn
Subject: New Indy - term sheet/Appendix A further discussion if needed

When: Wednesday, November 3, 2021 1:00 PM-1:30 PM (UTC-05:00) Eastern Time (US & Canada).
Where: Microsoft Teams Meeting

Hi All,

I am scheduling this time to go over the term sheet/Appendix A that we discussed yesterday afternoon and the revised draft that I shared this morning (attached as a SharePoint doc again for convenience). I want to make sure I capture all of your comments/concerns.

Thanks!
Marirose

Microsoft Teams meeting

Join on your computer or mobile app
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By participating in EPA hosted virtual meetings and events, you are consenting to abide by the agency's terms of use. In addition, you acknowledge that content you post may be collected and used in support of FOIA and eDiscovery activities.

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Message

From: Pratt, Marirose [Pratt.Marirose@epa.gov]
Sent: 11/9/2021 9:48:08 PM
To: Cobery, Jim [JimC@TheKraftGroup.com]; Stephanie Blackman [sblackman@schwarzpartners.com]; Sparks, Mallory S. [mallorysparks@parkerpoe.com]; Weber, Steven D. [steveweber@parkerpoe.com]
CC: Caballero, Kathryn [Caballero.Kathryn@epa.gov]; Nowell, Valerie [Nowell.Valerie@epa.gov]; O'Rourke, Steve (ENRD) [Steve.O'Rourke@usdoj.gov]; Valenzuela, Johanna (USASC) [Johanna.Valenzuela@usdoj.gov]
Subject: New Indy EPA's 2d draft CD and first draft Appendix A
Attachments: Comparison of EPA's 10-7-21 1st CD draft to 11-9-21 2nd CD draft.docx; 11-9-2021_EPA 2d draft CD_Clean.docx; 11-9-21 Draft Appendix A - Work to be Performed.docx

Good afternoon,

Please find attached a revised clean draft of the consent decree, as well as a redline that compares this draft to EPA's first draft from October 7, 2021. The redline shows the changes we've made in response to New Indy's proposed edits from October 27, 2021, as well as a few other minor changes (revisions to add CDX to paragraph 71, removing the reference to FLU in paragraph 10, and updating the cross-reference in paragraph 33 to paragraph 22 rather than 20). It also includes comment bubbles explaining why EPA accepted or rejected some of New Indy's proposed edits. If we did not accept a proposed change and there is no comment bubble, it is because the proposed change would have altered standard model language and New Indy did not provide a case-specific reason for why the proposed change should be made.

I've also included a new draft Appendix A. This document is intended to take the place of the term sheet we've been negotiating. We've included a few comment bubbles to explain/point out any substantive differences from the term sheet.

Please let me know if you have any questions.

We look forward to hearing from you soon.

Regards,
Marirose

Marirose J. Pratt
Senior Air Enforcement Attorney
Air & EPCRA Law Office
Office of Regional Counsel
U.S. Environmental Protection Agency, Region 4
Sam Nunn Atlanta Federal Center
61 Forsyth Street, S.W.
Atlanta, Georgia 30303-8960
Phone: 404-562-9023
Fax: 404-562- 9486
pratt.marirose@epa.gov

Message

From: Pratt, Marirose [Pratt.Marirose@epa.gov]
Sent: 11/8/2021 7:47:30 PM
To: O'Rourke, Steve (ENRD) [Steve.O'Rourke@usdoj.gov]; Nowell, Valerie [Nowell.Valerie@epa.gov]; Caballero, Kathryn [Caballero.Kathryn@epa.gov]; Valenzuela, Johanna (USASC) [Johanna.Valenzuela@usdoj.gov]
Subject: New Indy - Revised draft CD and Appendix A/term sheet
Attachments: 11-8-21 Draft Appendix A - Work to be Performed.docx; 11-8-2021_EPA 2d draft CD_Clean.docx; Comparison of EPA's 10-7-21 1st CD draft to 11-8-21 2nd CD draft.docx

Hi All,

Thank you for reviewing the draft documents I shared last week. Please find attached revised draft of the Appendix A/term sheet, a clean copy of the CD, and a redline comparing our initial draft CD with the clean copy with today's date. These are final drafts that I believe are ready to send to New Indy. I saved my responses to internal comment bubbles in Appendix A the SharePoint version I shared last week, so you should be able to reference that document if needed.

Please let me know if you see anything I missed or have any trouble accessing the documents.

Thank you!
Marirose

Marirose J. Pratt
Senior Air Enforcement Attorney
Air & EPCRA Law Office
Office of Regional Counsel
U.S. Environmental Protection Agency, Region 4
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Atlanta, Georgia 30303-8960
Phone: 404-562-9023
Fax: 404-562- 9486
pratt.marirose@epa.gov

1. Field Operations

In New Indy's response dated November 5, 2021, the company stated that the Teledyne hydrogen sulfide (H2S) monitor requires a sulfur dioxide (SO2) scrubber and heated catalyst to convert the H2S to SO2 which then can be measured, and that the use of the SO2 scrubber and catalyst lowers the volumetric flow rate. The Teledyne manual states that the typical volumetric flow rate is 650 cubic centimeters per minute (cm^3/m), however, according to New Indy's response, its consultant's experience has been that the volumetric flow rate for Teledyne monitors with an SO2 scrubber and a heated catalyst is typically between 580 to 600 cm^3/m. New Indy indicated that it will update its quality assurance project plan with the revised volumetric flow rate ranges. To help the EPA get a better understanding of the change in volumetric flow rate, please provide manufacturer, or other supporting, documentation on how the SO2 scrubber and the heated catalyst impact the volumetric flow rate to negate the 650 cm^3/min ±10% requirement.

2. Quality Assurance – Independent Performance Audit

In New Indy's response dated November 5, 2021, the company stated that the tables in the approved QAPP did not specify that the H2S monitors had to be evaluated at Audit Level 1, and that the three audit levels selected must challenge the monitor. The EPA believes that it is important to select audit levels over the entire range to ensure the monitor accuracy and data validity. Moving forward, the EPA requests that New Indy evaluate its monitors at Audit Level 1. Evaluating the monitors at this lower audit level is especially important to the integrity of the data when the H2S monitors, as they currently are, are reading on the lower end of the scale.

Concerning the Audit Level 5 which triggered a warning, New Indy confirmed that there was a warning level, that the monitor met the audit requirements and that the warning was likely caused by the audit gas lines not being adequately conditioned. The EPA believes that when a warning is triggered during a monitor audit, the warning must be investigated and documented, per Section 2.5.1 of the New Indy QAPP. Moving forward, EPA requests that New Indy conduct a root cause analysis of any warning, take the necessary corrective actions to address the warning, and maintain records of the warning, root cause analysis and the corrective actions taken. The EPA would also like New Indy to provide information of the corrective actions taken by the company to ensure that the audit gas lines are properly conditioned.

3. Quality Assurance – Quality Control Checks, Precision and Bias, and Zero Drift

In New Indy's response dated November 5, 2021, the company stated that calibration checks can fail for a number of reasons, that manual monitor checks were conducted, that no issues were identified, and that the monitoring data should not be invalidated. Similar to its position on audit checks, the EPA believes that when a monitor calibration check fails, the calibration check failure must be investigated and documented, per Section 2.6 of the New Indy QAPP. Moving forward, EPA requests that New Indy conduct a root cause analysis of the calibration check failure, take the necessary corrective actions to address the failure, and maintain records of root cause analysis and the corrective actions taken for the failure. In addition, New Indy must maintain documentation as to why the data is valid or why the data was invalidated.

4. Monitor Location Siting

In New Indy's response dated November 5, 2021, the company stated that it would revise the QAPP to change the dripline requirement from 20 meters to 10 meters, that the EPA approved the location of monitoring station #3, that the data collected by the monitor should be valid, and that the EPA and the company had multiple conversations about relocating monitoring station #3. The EPA did approve the current location of monitoring station #3, but it was the company's responsibility to meet the siting specifications in the approved QAPP, including the distances from the dripline of the trees. Moving forward, as documented in the November 18, 2021 6:31 AM email from Marirose Pratt to Jim Cobery, the EPA accepts New Indy's proposal to leave monitoring station #3 in the current location, provided that New Indy modify the site to comply with the QAPP. The EPA does not believe that there is any need for New Indy to install an Acrulog H2S monitor at the Catawba Express Convenient Store.

Appointment

From: Pratt, Marirose [Pratt.Marirose@epa.gov]
Sent: 11/30/2021 10:27:02 AM
To: Russo, Todd [Russo.Todd@epa.gov]; Dressler, Jason [Dressler.Jason@epa.gov]; Taylor, Kevin [Taylor.Kevin@epa.gov]; Kler, Denis [Kler.Denis@epa.gov]; Mills, Andrew [mills.andrew@epa.gov]
CC: Caballero, Kathryn [Caballero.Kathryn@epa.gov]; Nowell, Valerie [Nowell.Valerie@epa.gov]

Subject: New Indy - discussion of NIC's proposed edits to Appendix A
Attachments: 11-30-21_EPA's_2nd Draft Appendix A - Work to be Performed.docx; Appendix IV - Passive Post Aeration Basin Cover System 11-29 (002).docx; Appendix V - Spill Containment 11-29 (002).docx
Location: Microsoft Teams Meeting

Start: 11/30/2021 3:00:00 PM
End: 11/30/2021 3:30:00 PM
Show Time As: Tentative

Required Attendees: Russo, Todd; Dressler, Jason; Taylor, Kevin; Kler, Denis; Mills, Andrew
Optional Attendees: Caballero, Kathryn; Nowell, Valerie

Good morning,

Please find attached New Indy's redline of Appendix A, with a few comment bubbles from me to guide our discussion. I'm also attaching two documents that New Indy provided describing the black liquor containment and post aeration basin cover system. Please look over these before we meet if you have time.

Thanks!
Marirose

Microsoft Teams meeting

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Passive Post Aeration Basin Cover System:

Concept:
The existing carbon filtration system incorporates a solid cover over the Post Aeration Basin ("PAB") with a few openings for allowing air intrusion into the vapor space of the basin. A ductwork header and suction inlets are created with corrugated plastic piping which then feeds a blower fan. The blower fan pushes the vapors from the PAB through an activated carbon filter and then exhausts through a discharge pipe to ambient atmosphere. This current system is an "active" system because it includes a blower fan.

The alternate "passive" system simply utilizes the existing air movement actions of the induction aerators to bring air into the basin which then dissipates through the liquid effluent and discharges by natural convection upwards into the vapor space and then out of the basin. To filter these vapors, a cover will be installed which uses this natural convection process to capture any odorous compounds and have them flow through activated carbon "patches" which are both replaceable and built into the cover of this PAB filtration system. No fan is required, hence the "passive" nature of the system. The initial intent is to replace the carbon patches at twice the frequency recommended by the vendor.

Description:
Anue Water Technologies' Engineered Odor Control System technology is a patented, custom designed Geomembrane system with integrated odor control filters to reduce odor emissions. The membrane is supported by a cable grid and batten bars above the surface, making it unaffected by aeration, changing water levels, foaming, bacteria and other common issues. Custom access and viewing ports allow for uninterrupted maintenance. The engineered specialty filter inserts are designed to last 9 to 18 months, but they may be changed more often as needed depending on ambient monitoring emissions levels.

The mill has requested a proposal from Anue Water Technologies for an EOCS Geomembrane system for the PAB. The objective of the project is to reduce the odors emanating from the PAB. The PAB has the dimensions of 40' x 61', 2440ft2 (12.2m x 18.6m, 226.9m2) (Fig. 1).

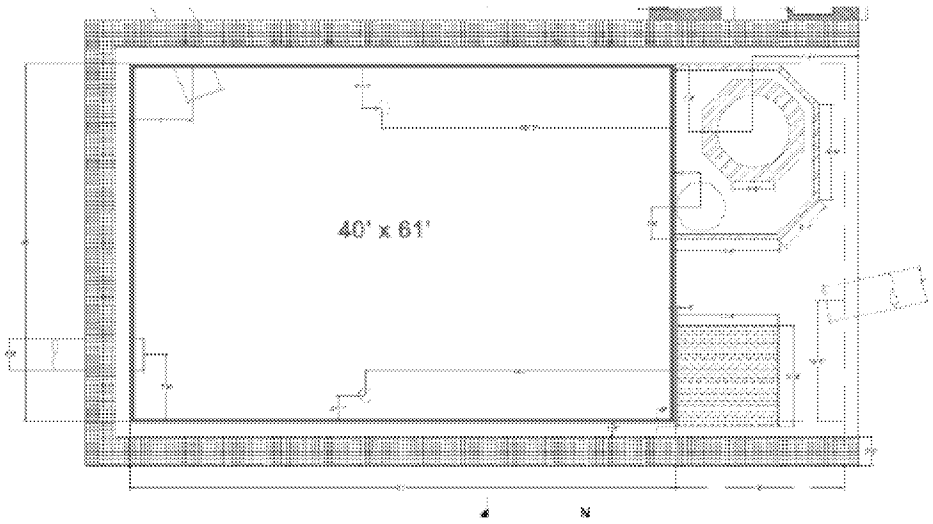

Fig. 1

The EOCS Geomembrane will have 99 filter pockets and one access port. The preliminary design of the membrane is in Fig. 2. The support of the membrane will consist of steel cables across the PAB in both directions. The PAB has pre-existing cables installed at an interval of 48" which will be left in place and additional cables will be installed in between. Because of the extensive size of the membrane, double cables will be used in the middle of the Basin.

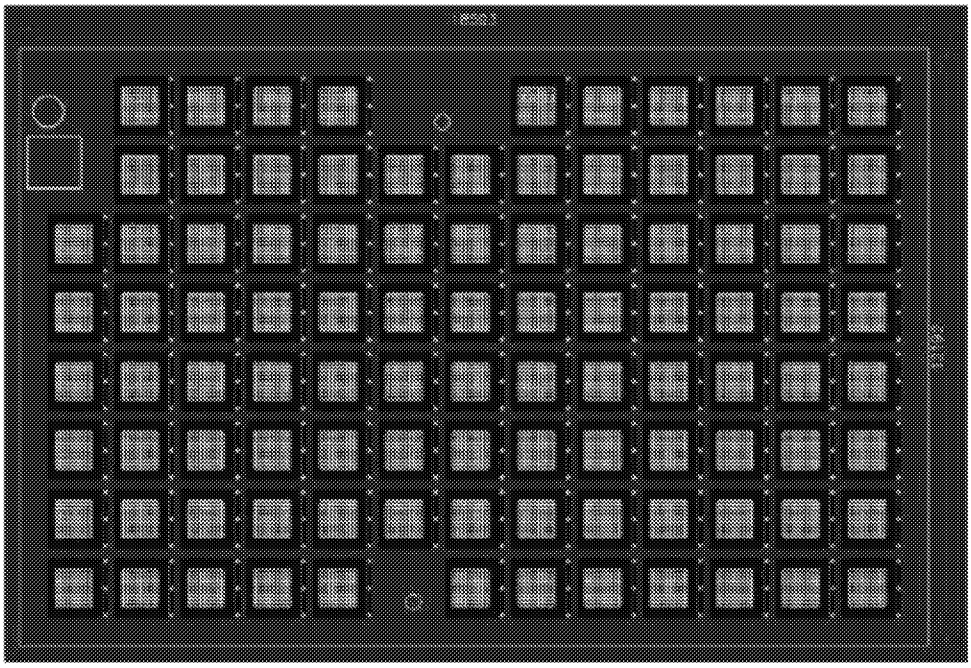

Fig. 2

The EOCS Geomembrane consists of a highly resistant, non-porous membrane with activated carbon filters enclosed inside pockets (Fig. 3). The hook and loop (aka Velcro) pockets allow for easy access to change the filters (Fig. 4). The membrane is rested on top of the support cables crossing the PAB. The EOCS Geomembrane fastening system consists of batten bars that are fitted and anchored with expansion bolts on the side of the edges of PAB (Fig. 5). The membrane is placed between two batten bars. The batten bars are installed in the horizontal or vertical part of the Basin wall depending on the circumstances of potential obstructions in the PAB. The design of the cover, along with the size and placement of the filters, may vary and depend on the circumstances of each individual project. Anue Water Technologies has customized the placement of the filters based upon the design and specifications of the PAB.

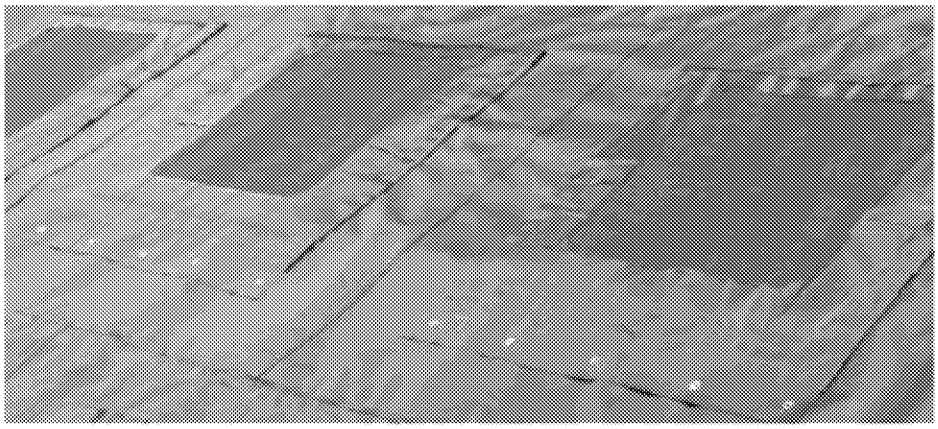

Fig. 3

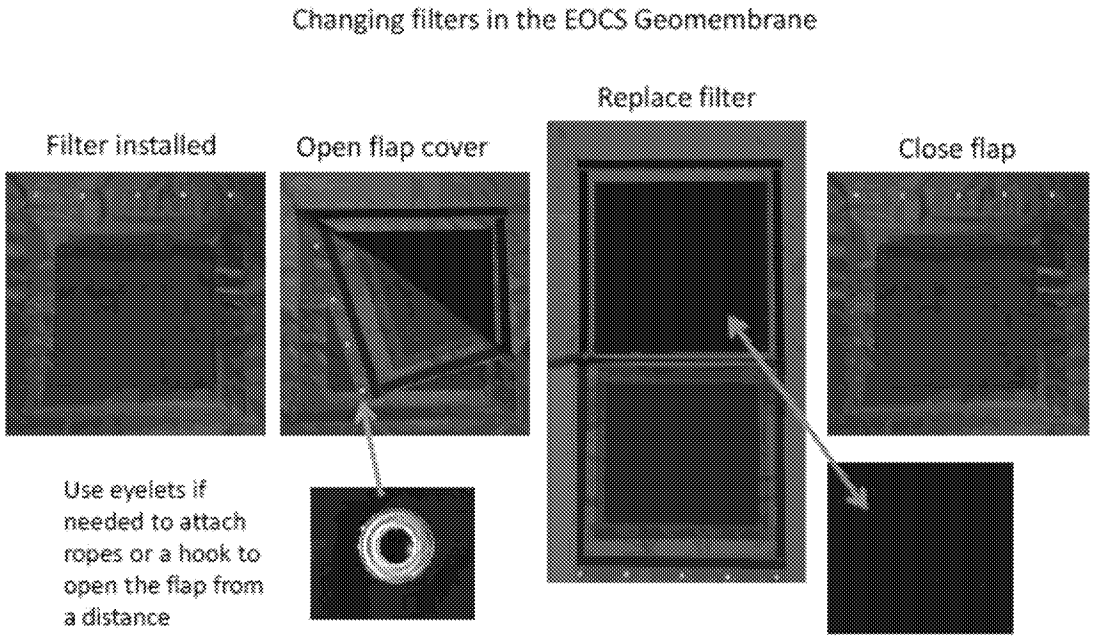

Fig. 4

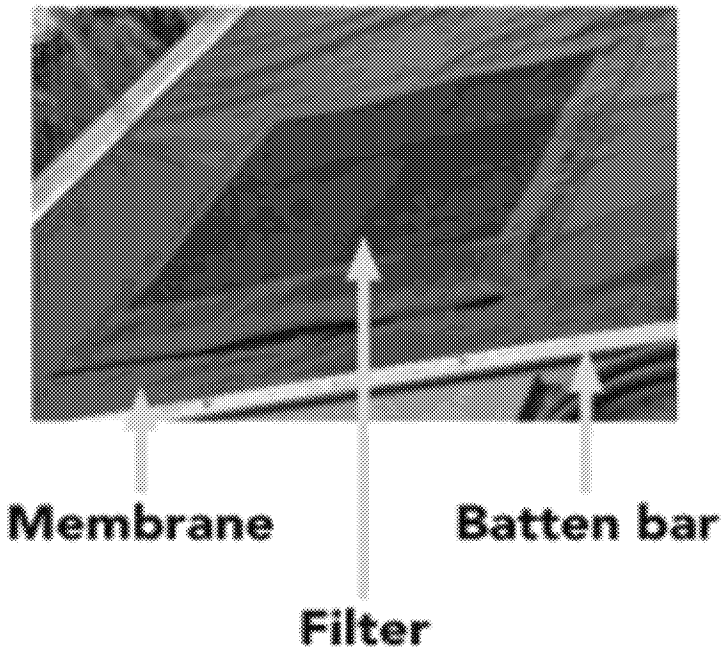

Fig. 5

Spill Containment:

Description:
Four locations have been identified at the Powerhouse and Fiberline that need additional modifications to help prevent black liquor from entering the wastewater treatment system and causing impairments. The locations are No. 9 Sewer, No. 10 Sewer, Tile Tank Black Liquor Storage, and the Fiberline West (formerly Acid) Sewer. The rationale is to implement means to collect and pump back liquor losses to collecting tanks for minor and moderate releases and mitigate impacts from major releases by pumping process releases back into the process vessels.

Presently, there are no means for collecting and pumping liquor releases of up to a nominal 400 gpm from key areas in the mill which presents elevated exposure risks to the Wastewater Treatment System. Liquor releases are a result of gasket, packing and seal leaks, minor piping failures, and rapid unplanned shutdowns to major process equipment. Characteristics of the releases are high BOD, elevated conductivity (e.g. alkali loss) and a tendency to cause foaming issues in the ASB.

The project will capture four (4) sources in the Powerhouse and Fiber Line: Tile Tank area, No.9 Sewer, No. 10 Sewer, and Fiber Line West (formerly Acid) sewer. Completion of this project will mitigate risk from highest potential locations and help ensure that Black Liquor will not get into the mill's Wastewater Treatment System. These modifications will support protections to the existing and future modifications to the WWTS at the Catawba Mill.

To mitigate releases to the balance of the wastewater treatment system, sumps will be constructed at the No. 9, No. 10, and Tile Tank locations. Each location is being designed to accommodate nominal 400 gpm liquor releases. A vertical chopper-type sump pump will be installed at each point of collect. Releases to the No. 9 and No. 10 sewer sumps will be directed to the Weak Black and Spare Liquor Tanks. Releases to the Tile Tank Sump will go to back to either the North or South Liquor Tanks. Releases to the Fiberline West (Acid) Sewer will be directed to the spill collection tank; special provisions will need to be made in this location due to the use of acid for pH control and preventing low pH effluent from being put back into the process. A new conductivity probe will be installed at the Tile Tank sump; existing probes will be at the other locations. Contact level switches will be installed at each location for pump start/stop and alarming in the respective area DCS.

Passive Post Aeration Basin Cover System:

Concept:
The existing carbon filtration system incorporates a solid cover over the Post Aeration Basin ("PAB") with a few openings for allowing air intrusion into the vapor space of the basin. A ductwork header and suction inlets are created with corrugated plastic piping which then feeds a blower fan. The blower fan pushes the vapors from the PAB through an activated carbon filter and then exhausts through a discharge pipe to ambient atmosphere. This current system is an "active" system because it includes a blower fan.

The alternate "passive" system simply utilizes the existing air movement actions of the induction aerators to bring air into the basin which then dissipates through the liquid effluent and discharges by natural convection upwards into the vapor space and then out of the basin. To filter these vapors, a cover will be installed which uses this natural convection process to capture any odorous compounds and have them flow through activated carbon "patches" which are both replaceable and built into the cover of this PAB filtration system. No fan is required, hence the "passive" nature of the system. The initial intent is to replace the carbon patches at twice the frequency recommended by the vendor.

Description:
Anue Water Technologies' Engineered Odor Control System technology is a patented, custom designed Geomembrane system with integrated odor control filters to reduce odor emissions. The membrane is supported by a cable grid and batten bars above the surface, making it unaffected by aeration, changing water levels, foaming, bacteria and other common issues. Custom access and viewing ports allow for uninterrupted maintenance. The engineered specialty filter inserts are designed to last 9 to 18 months, but they may be changed more often as needed depending on ambient monitoring emissions levels.

The mill has requested a proposal from Anue Water Technologies for an EOCS Geomembrane system for the PAB. The objective of the project is to reduce the odors emanating from the PAB. The PAB has the dimensions of 40' x 61', 2440ft2 (12.2m x 18.6m, 226.9m2) (Fig. 1).

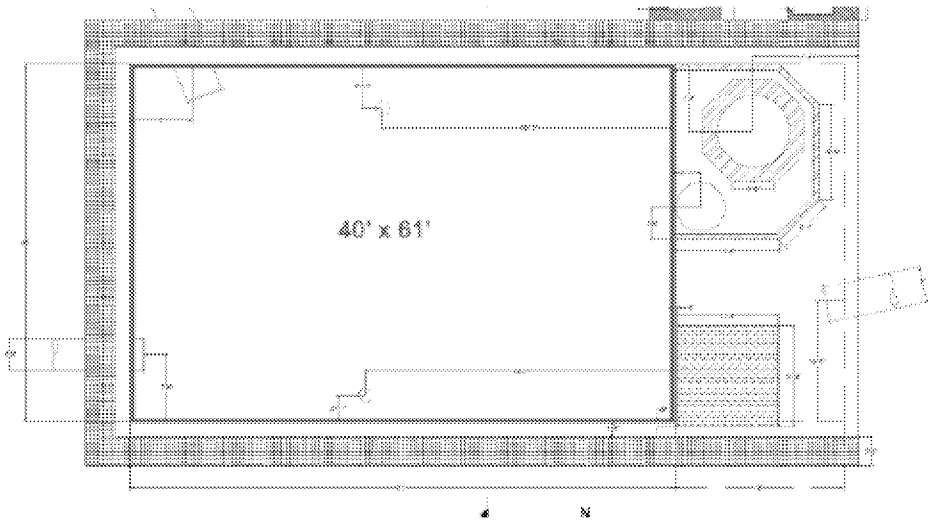

Fig. 1

The EOCS Geomembrane will have 99 filter pockets and one access port. The preliminary design of the membrane is in Fig. 2. The support of the membrane will consist of steel cables across the PAB in both directions. The PAB has pre-existing cables installed at an interval of 48" which will be left in place and additional cables will be installed in between. Because of the extensive size of the membrane, double cables will be used in the middle of the Basin.

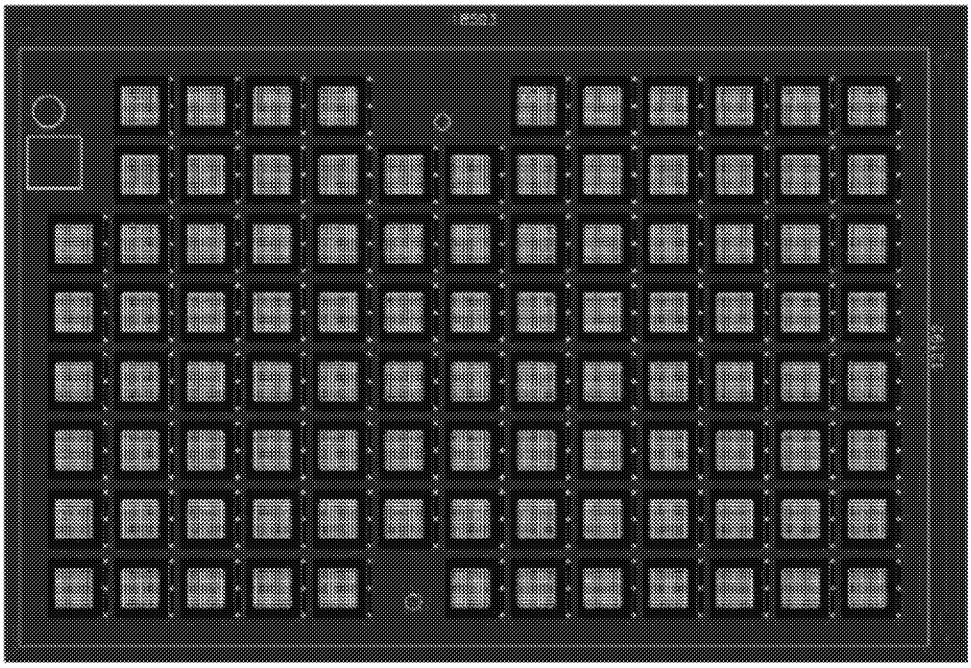

Fig. 2

The EOCS Geomembrane consists of a highly resistant, non-porous membrane with activated carbon filters enclosed inside pockets (Fig. 3). The hook and loop (aka Velcro) pockets allow for easy access to change the filters (Fig. 4). The membrane is rested on top of the support cables crossing the PAB. The EOCS Geomembrane fastening system consists of batten bars that are fitted and anchored with expansion bolts on the side of the edges of PAB (Fig. 5). The membrane is placed between two batten bars. The batten bars are installed in the horizontal or vertical part of the Basin wall depending on the circumstances of potential obstructions in the PAB. The design of the cover, along with the size and placement of the filters, may vary and depend on the circumstances of each individual project. Anue Water Technologies has customized the placement of the filters based upon the design and specifications of the PAB.

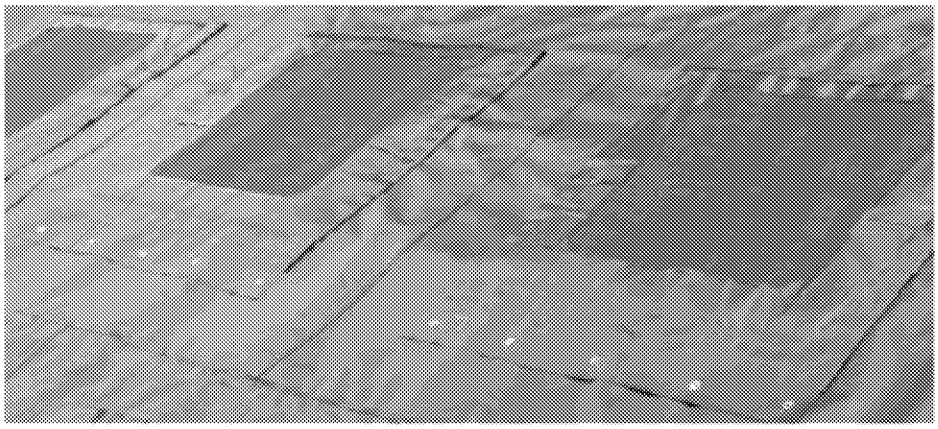

Fig. 3

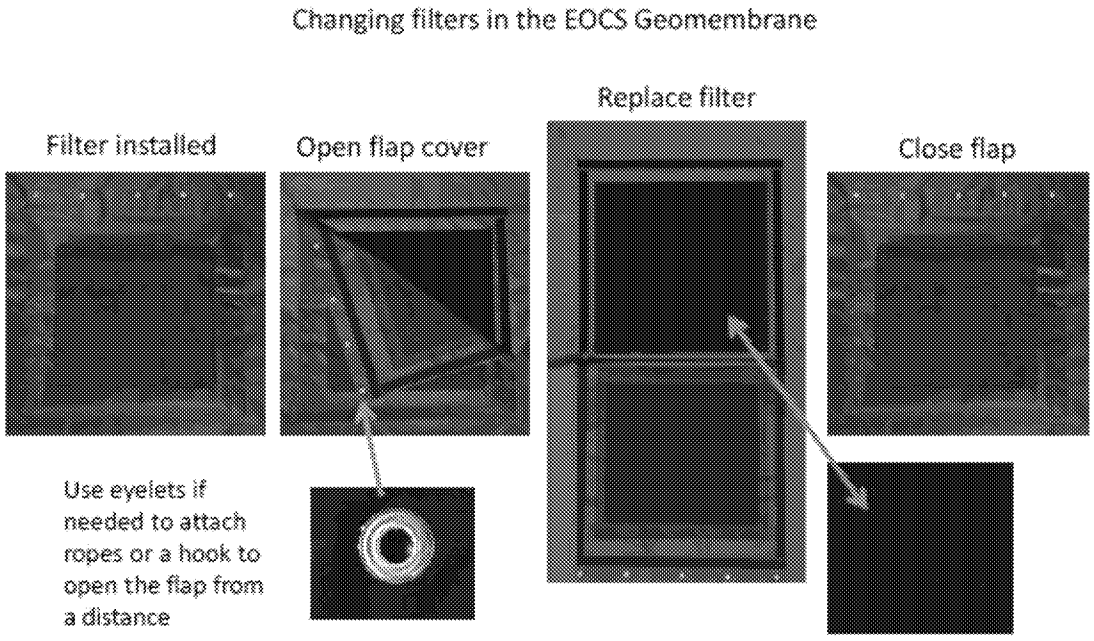

Fig. 4

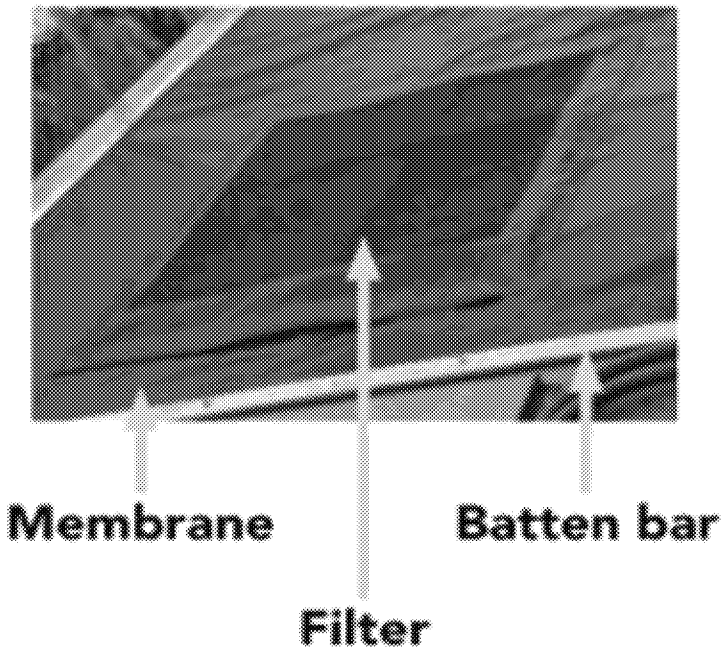

Fig. 5

Message

From: Kler, Denis [Kler.Denis@epa.gov]
Sent: 11/1/2021 5:51:56 PM
To: Held, Brendan [Held.Brendan@epa.gov]
CC: Taylor, Kevin [Taylor.Kevin@epa.gov]; Mills, Andrew [mills.andrew@epa.gov]; Foley, Patrick [Foley.Patrick@epa.gov]; Pratt, Marirose [Pratt.Marirose@epa.gov]
Subject: New Indy ORP papers
Attachments: ORP information.pdf; ORP YSI article 2008.pdf

Brendan,
Attached are the documents for ORP.

Denis B. Kler
U.S. EPA Region 4
Enforcement and Compliance Assurance Division
Policy, Oversight and Liaison Office
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Oxidation-Reduction Potential (ORP)

What is oxidation-reduction potential?

Oxidation-reduction potential (ORP) measures the ability of a lake or river to cleanse itself or break down waste products, such as contaminants and dead plants and animals. When the ORP value is high, there is lots of oxygen present in the water. This means that bacteria that decompose dead tissue and contaminants can work more efficiently. In general, the higher the ORP value, the healthier the lake or river is. However, even in healthy lakes and rivers, there is less oxygen (and therefore lower ORP values) as you get closer to the bottom sediments (mud; see the picture below of a lake bottom). This is because there are many bacteria working hard in the sediments to decompose dead tissue, and they use up a lot of the available oxygen. In fact, oxygen disappears very quickly in the bottom mud (often within a centimeter or two) and ORP falls quickly. ORP is measured in addition to dissolved oxygen because ORP can provide scientists with additional information of the water quality and degree of pollution, if present. Also, there are other elements that can function like oxygen (in terms of chemistry) and contribute to increased ORP.

Photo credit: K. Thomason
http://www.flickr.com/photos/kthomason/375296752/in/photostream/

Why does oxidation-reduction potential matter?

ORP depends on the amount of dissolved oxygen that is in the water, as well as the amount of other elements that function similarly to oxygen. Though not technically correct, oxygen and other elements that contribute to high ORP effectively help 'eat' things that we don't want in the water – such as contaminants and dead tissues. When ORP is low, dissolved oxygen is low, toxicity of certain metals and contaminants can increase, and there is lots of dead and decaying

material in the water that cannot be cleared or decomposed. This is obviously not a healthy environment for fish or bugs. In healthy waters, ORP should read high between 300 and 500 millivolts. In the North, we might expect low ORP in waters that receive sewage inputs or industrial waste.

How do we measure oxidation-reduction potential?

ORP is measured directly in the lake or river water that you are investigating using an ORP sensor. ORP is measured in millivolts (mV) and the more oxygen that is present in the water, the higher the ORP reading is. ORP can either be above zero or below zero.

References/For More Information

Horne, A. J., and Goldman, C. R. 1994. Limnology, 2nd edition. McGraw-Hill, Inc. 576 pp.

Wetzel, R. G. 1983. Limnology, 2nd edition. Saunders College Publishing. 760 pp.

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Application Note

ORP Management in Wastewater as an Indicator of Process Efficiency

The following article is reprinted with the permission of the New England Interstate Water Pollution Control Commission (NEIWPCC). It was written by Michael H. Gerardi, and appeared in the Winter 2007 issue of NEIWPCC's newsletter, *Interstate Water Report*. To view the original, please visit, www.neiwpcc.org/iwr/reductionpotential.asp.

Oxidation-reduction potential or ORP has been used for many years in facilities that process wastewater generated by metal finishing plants, but only recently has it become prominent in municipal wastewater treatment plants. When using a typical ORP device, an operator inserts a probe directly into a plant's tank or waste stream (usually two feet below the surface level). The probe contains a sensor that measures electrical charges from particles called ions, and these charges are converted to millivolts (mV) that can be either negatively or positively charged. Unlike "wet Chemistry" analysis that can be time-consuming and complex, ORP readings are instantaneous and easy to perform. And like all sampling measurements taken by operators, they are snapshots in time that can indicate process efficiency and identify treatment problems before they affect effluent quality.

A typical wastewater sampling application in the aeration basin.

When used in a wastewater treatment systems, oxidation-reduction potential is a measurement of the ability or potential of wastewater to permit the occurrence of specific biological (oxidation-reduction) reactions. Important oxidation-reduction reactions in wastewater treatment systems include nitrification, denitrification, biological phosphorus removal, biological malodor production, and the removal of cBOD (carbon- and hydrogen- containing compounds). These reactions involve carbon (C), phosphorus (P), sulfur (S), and nitrogen (N) and their change from oxidized states (containing oxygen) such as nitrate (NO3-) and sulfate (SO42-) and reduced states (containing hydrogen) such as ammonia (NH3) and sulfides (H2S).

Oxidation-reduction potential is measured in millivolts (mV). On the ORP scale, the presence of an oxidizing agent such as oxygen increases the ORP value, while the presence of a reducing agent such as substrate or cBOD decreases the ORP value.

By monitoring the ORP of wastewater, an operator can determine what biological reaction is occurring and if operational conditions should be changed to promote or prevent that reaction. For example, an operator doesn't want denitrification or "clumping" to occur in a secondary clarifier; the operator, therefore, must maintain an ORP value of more than +50 mV to prevent clumping. Similarly, an operator doesn't want malodor production to occur in the sewer system. So, the operator must maintain an ORP value of more than -50 mV to prevent sulfide formation and an ORP value of more than -100 mV to prevent volatile acid formation.

Let's take a look at each of these reactions and their relation to ORP values in greater detail.

Nitrification

To satisfy discharge limits for total nitrogen or ammonia, wastewater treatment plants must nitrify. Nitrification is the oxidation of ionized ammonia (NH4+) to nitrate (NO3-) and is performed by nitrifying bacteria when the ORP of the wastewater is +100 to +350 mV.

Denitrification

Denitrification is performed to satisfy total nitrogen discharge limits or destroy undesired filamentous organism growth. Denitrification is the reduction of nitrate (NO3-) to molecular nitrogen (N2) and is performed by denitrifying bacteria with ORP of the wastewater is +50 to -50 mV.

Biological Phosphorus Removal

Wastewater plants conduct biological phosphorus removal to meet total phosphorus discharge limits. The process consists of two treatment steps - first, biological phosphorus release and, second, biological phosphorus removal. In biological phosphorus release, fermentative bacteria produce fatty acids in an anaerobic tank having an ORP range of -100 to -225 mV. When the acids are absorbed by phosphorus-accumulating bacteria, the bacteria release phosphorus to the bulk solution.

In the second step - biological phosphorus removal - the phosphorus-accumulating bacteria degrade the absorbed acids in an aerobic tank and store the energy that was obtained from the degraded acids in phosphorus granules. This storage of energy requires the removal of large quantities of phosphorus from the bulk solution. The storage of phosphorus granules or biological phosphorus removal occurs when the ORP of the aerobic tank is +25 to +250 mV.

(continued)

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Sulfide Formation and Fermentation (Biological Malodor Production)

Biological malodor production occurs through two major biochemical reactions, sulfide (-SH) formation and acid formation (fermentation). Hydrogen sulfide is produced in large quantity when sulfate-reducing bacteria degrade substrate using sulfate (SO42-). Sulfate is found in groundwater and urine and when reduced through bacterial activity, hydrogen sulfide (H2S) is formed. Sulfide formation, which occurs when the ORP is between -50 to -250 mV, is a critical event in an anaerobic digester, where the sulfide serves as a sulfur nutrient for facultative anaerobic and anaerobic bacteria including the methane-producing bacteria.

During the equally critical event of fermentation, acid-forming or fermentative bacteria produce a large variety of volatile acids, nitrogen-containing compounds, and sulfur-containing compounds. Many of these volatile compounds are malodorous. Acid formation or fermentation occurs when the ORP is between -100 and -225 mV. Fermentation is particularly crucial in biological phosphorus removal systems where the production of fatty acids is required for phosphorus release. Fermentation is also important in anaerobic digesters where many of the acids and alcohols produced through fermentation are used by methane-forming bacteria to produce methane.

Biochemical Reactions and Corresponding ORP Values

Biochemical Reaction	ORP, mV
Nitrification	+100 to +350
cBOD degradation with free molecular oxygen	+50 to +250
Biological phosphorus removal	+25 to +250
Denitrification	+50 to -50
Sulfide (H_2S) formation	-50 to -250
Biological phosphorus release	-100 to -250
Acid formation (fermentation)	-100 to -225
Methane production	-175 to -400

However, these reactions must be appropriately confined. Septic conditions that permit sulfide formation and the discharge of sulfide into an activated sludge process should be corrected. The presence of sulfide promotes the growth of undesirable sulfide-loving filamentous organisms such as *Beggiatoa spp.*, *Thiothrix spp.*, and type 021N.

cBOD Degradation with Free Molecular Oxygen

Removal or degradation of cBOD with free molecular oxygen (O2) occurs when the ORP in the reaction tank or aeration tank is between +50 to +250 mV. The degradation is performed by cBOD-removing bacteria. The bacteria are aerobes (using only free molecular oxygen) or facultative anaerobes (using free molecular oxygen or another molecule such as nitrate).

Methane Production

Methane (CH4) production is highly desired in an anaerobic digester and undesired in a sewer system. Methane production is performed by methane-forming bacteria and occurs over a large range of ORP values, from -175 to -400 mV.

Knowing the ORP values associated with specific reactions has allowed operators to use ORP probes, and the information gleaned from them, in a variety of helpful ways. Within a sewer system, for example, an ORP value less than -100 mV indicates the production of malodors due to sulfide formation and fatty acid production. By adding sodium nitrate (Na2NO3) to a manhole, it's possible to increase the ORP value above -50 mV and prevent biological malodor production.

In another example, the transfer of thickener sludge that is heavily laden with nitrate to an anaerobic digester may be regulated by monitoring the ORP of the digester sludge. As the ORP increases from -400 mV, the transfer of thickener sludge may be terminated at a value less than -300 mV to prevent the loss of significant methane production.

Consider too that the absence of denitrification within a denitrification tank may be detected with the use ORP and hydraulic retention time of the tank or cBOD feed (methanol or acetate) to the tank may be adjusted to promote denitrification. Likewise, the occurrence of biological phosphorus release may be monitored in a fermentative tank and if needed, hydraulic retention time may be increased in order to remove residual free molecular oxygen and nitrate that contribute to ORP values of more than -100 mV.

ORP probes are extremely versatile measurement systems for monitoring biological reactions within sewer systems and wastewater treatment plants, and for indicating to operators if acceptable or unacceptable biological activity is occurring. Increasingly, they are a tool that wastewater treatment plants must have and that operators must know how to use.

For additional wastewater information including specifications on YSI instruments, please visit:

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